

What is claimed is:

1 1. A negative photoresist composition with multi-
2 reaction systems, comprising the following components as a
3 uniform solution in an organic solvent:

4 at least one saturated or unsaturated resin;

5 at least one photoinitiator in an amount of 0.1 to 35
6 parts by weight, based on 100 parts by weight of
7 the saturated or unsaturated resin;

8 at least one free radical reactive monomer in an amount
9 of 0.1 to 100 parts by weight;

10 at least one photoacid generator in an amount of 0.1 to
11 35 parts by weight; and

12 at least one cation reactive monomer in an amount of
13 0.1 to 35 parts by weight.

1 2. The negative photoresist composition as claimed in
2 claim 1, wherein the multi-reaction systems comprise free-
3 radical polymerizations and cation polymerizations.

1 3. The negative photoresist composition as claimed in
2 claim 1, wherein the saturated or unsaturated resin is
3 selected from the group consisting of homopolymers,
4 copolymers, and combinations thereof, which the homopolymers
5 and the copolymers are synthesized by at least one monomer
6 selected from the group consisting of styrene, methyl
7 styrene, acrylic acid, acrylate, methyl lacrylic acid,
8 methyl acrylate, vinyl ether, and combinations thereof.

1 4. The negative photoresist composition as claimed in
2 claim 1, wherein the saturated or unsaturated resin is

3 selected from the group consisting of acrylic resin,
4 polyester, polyurethane, polyether, epoxy acrylate and
5 combinations thereof.

1 5. The negative photoresist composition as claimed in
2 claim 1, wherein the saturated or unsaturated resin has a
3 molecular weight in the range from 5,000 to 250,000 and an
4 acid value between 50 and 250mgKOH/g.

1 6. The negative photoresist composition as claimed in
2 claim 1, wherein the saturated or unsaturated resin has a
3 molecular weight in the range from 10,000 to 100,000 and an
4 acid value between 70 and 150mgKOH/g.

1 7. The negative photoresist composition as claimed in
2 claim 1, wherein the at least one photoinitiator is present
3 in an amount of 0.1-10 parts by weight, based on 100 parts
4 by weight of the saturated or unsaturated resin.

1 8. The negative photoresist composition as claimed in
2 claim 1, wherein the photoinitiator is selected from the
3 group consisting of benzoin, benzoin alkyl ether, benzil
4 ketals, acetophenones derivatives, benzophenone, 4,4'-
5 dimethyl-amino-benzophenone, thioxanthenes derivatives,
6 morpholino-1-propanone, and combinations thereof.

1 9. The negative photoresist composition as claimed in
2 claim 1, wherein the at least one free radical reactive
3 monomer is present in an amount of 5-25 parts by weight,
4 based on 100 parts by weight of the saturated or unsaturated
5 resin.

1 10. The negative photoresist composition as claimed in
2 claim 1, wherein the free radical reactive monomer is
3 selected from the group consisting of tetraethylene glycol
4 diacrylate, tetraethylene glycol dimethacrylate,
5 neopentylglycol diacrylate, neopentylglycol dimethyl
6 acrylate, polyethylene glycol diacrylate, polyethylene
7 glycol dimethylacrylate, ethoxylated bisphenol A glycol
8 diacrylate, ethoxylated bisphenol A glycol dimethyl
9 acrylate, trimethylolpropane trimethacrylate,
10 trimethylolpropane triacrylate, pentaerythritol triacrylate,
11 ethoxylated trimethylolpropane triacrylate, glyceryl propoxy
12 triacrylate, pentaerythritol tetraacrylate,
13 dipentaerythritol pentaacrylate, glycidyl acrylate,
14 glycidylmethyl acrylate, p-epoxy-styrene, p-glycidyl-
15 styrene, allyl glycidyl ether, 3-glycidyloxy-propyl
16 trimethoxy silane, β -(3,4-epoxycyclohexyl)-ethyl
17 trimethoxysilane, γ -glycidoxypropyl trimethoxysilane, and
18 combinations thereof.

1 11. The negative photoresist composition as claimed in
2 claim 1, wherein the at least one photoacid generator is
3 present in an amount of 0.1-10 parts by weight, based on 100
4 parts by weight of the saturated or unsaturated resin.

1 12. The negative photoresist composition as claimed in
2 claim 1, wherein the photoacid generator is selected from
3 the group consisting of onium salt, triarylsulfonium salt,
4 alkylarylsulfonium salt, diaryliodonium salt,
5 diarylchloronium salt, diarylbromonium salts, sulfonates,

6 diazonium salt, diazonaphthoquinone sulfonate, and
7 combinations thereof.

1 13. The negative photoresist composition as claimed in
2 claim 1, wherein triarylsulfonium salt is selected from the
3 group consisting of triaryl sulfonium hexafluorophosphate,
4 triphenyl triflate, triphenyl stibnite, methoxy triphenyl
5 triflate, methoxy triphenyl stibnite, and trimethyl
6 triphenyl triflate and combinations thereof.

1 14. The negative photoresist composition as claimed in
2 claim 1, wherein the at least one cation reactive monomer is
3 present in an amount of 5-25 parts by weight, based on 100
4 parts by weight of the saturated or unsaturated resin.

1 15. The negative photoresist composition as claimed in
2 claim 1, wherein the cation reactive monomer is selected
3 from the group consisting of vinyl ether monomer, epoxy
4 monomer, and derivatives thereof.

1 16. The negative photoresist composition as claimed in
2 claim 1, wherein the cation reactive monomer is selected
3 from the group consisting of cycloaliphatic diepoxide, N,N-
4 diglycidyl-4-glycidylloxylaniline, 3,4-epoxycyclohexylmethyl
5 carboxylate, 3,4-epoxycyclohexane carboxylate, 1,2-
6 cyclohexane diglycidyl dicarboxylate, 1,4-cyclohexane
7 dimethanol diglycidyl ether, ethylene glycol divinyl ether,
8 diethylene glycol divenyl ether, triethylene glycol divinyl
9 ether, 1,4-cyclohexane dimethanol divinyl ether, lactones
10 and combinations thereof.

1 17. The negative photoresist composition as claimed in
2 claim 1, further comprising:

3 at least one epoxy resin in an amount of 0.1 to 50
4 parts by weight, based on 100 parts by weight of
5 the saturated or unsaturated resin; and

6 at least one resin hardener in an amount of 0.1 to 30
7 parts by weight.

1 18. The negative photoresist composition as claimed in
2 claim 17, wherein the epoxy resin is selected from the group
3 consisting of bisphenol A epoxy resin, brominated epoxy
4 resin, phenolic novolac epoxy resin, cresol novolac epoxy
5 resin, naphthalene epoxy, dicyclopentadiene novolac epoxy,
6 cycloaliphatic epoxy, isocyanate epoxy and combinations
7 thereof.

1 19. The negative photoresist composition as claimed in
2 claim 17, wherein the resin hardener is selected from the
3 group consisting of aliphatic amine, aromatic amine,
4 polyamide, dicyandiamide, imidazoles, anhydride and
5 combinations thereof.

1 20. A method of forming pattern using a negative
2 photoresist composition with multi-reaction systems,
3 comprising:

4 forming a photoresist film on a substrate using a
5 negative photoresist composition, wherein the
6 negative photoresist composition comprises the
7 following components as a uniform solution in an
8 organic solvent:

9 at least one saturated or unsaturated resin;
10 at least one photoinitiator in an amount of 0.1 to 35
11 parts by weight, based on 100 parts by weight of
12 the saturated or unsaturated resin;
13 at least one free radical reactive monomer in an amount
14 of 0.1 to 100 parts by weight;
15 at least one photoacid generator in an amount of 0.1 to
16 35 parts by weight;
17 at least one cation reactive monomer in an amount of
18 0.1 to 35 parts by weight;
19 providing an actinic ray or radiation to expose
20 predetermined patterns of the photoresist film;
21 and
22 developing the photoresist film with an alkaline
23 developing solution.

1 21. The method as claimed in claim 20, wherein the
2 actinic ray is a uniform ultraviolet with a wavelength about
3 365nm.